

We Claim:

1. A communication system for at least one of monitoring the performance of an implantable medical device (IMD) implanted within a body of a patient, monitoring the health of the patient and remotely delivering a therapy to the patient through the IMD, the IMD being capable of bi-directional communication with a communication module located external to the patient's body, the system comprising:

- (a) the IMD, the IMD comprising a memory having software loaded therein and means for permitting the software to be at least one of updated and reprogrammed after the IMD has been implanted within the patient's body, and
- (b) the communication module, the communication module further comprising means for at least one of updating and reprogramming at least portions of the software loaded in the IMD;
- (c) a mobile telephone operably connected to the communication module and capable of receiving software information therefrom or relaying software information thereto;
- (e) a remote computer system capable of initiating the downloading of updated or new software to the IMD via the communication system and the communication module;
- (f) a communication system capable of bi-directional communication with the mobile phone and the remote computer system.

2. The system of claim 1, wherein the communication module is incorporated into the mobile telephone.

3. The system of claim 1, wherein the mobile telephone further comprises a Personal Data Assistant (PDA).

4. The system of claim 1, wherein the communication module is
5 a device separate and apart from the mobile telephone.

5. The system of claim 1, wherein the IMD and the communication module communicate with one another using radio-frequency telemetry.

6. The system of claim 1, wherein the communication module further comprises
10 at least one of a microprocessor, a controller, a CPU, a computer readable memory operably connected to a processor, and at least one RF communications circuit for transmitting information to and receiving information from the IMD.

7. The system of claim 1, wherein the communication module further comprises
15 a data output port, cable and connector for connection to a mobile telephone data input port of the mobile telephone.

8. The system of claim 1, wherein the communication module further comprises
20 in a memory thereof computer readable software for initiating and maintaining communications with the mobile telephone using standardized handshake protocols.

9. The system of claim 1, wherein the communication module further comprises
25 at least one of a telemetry signal strength indicator and a telemetry session success indicator.

10. The system of claim 1, wherein the communication module further comprises at least one of volatile RAM, non-volatile RAM, ROM, EEPROM, a hard or floppy

disk, and flash memory for storing at least one of patient data, IMD data, and software.

11. The system of claim 1, wherein the communication module further comprises at least one of a real-time clock, a battery, a serial output interface and a parallel output interface.

12. The system of claim 1, wherein the communication module is adapted to receive electrical power from at least one of a portable energy source disposed therewithin or connected thereto, a portable energy source disposed within or connected to the mobile telephone, and household line ac power.

13. The system of claim 1, wherein the communication module is plug-and-play compatible with the mobile telephone.

14. The system of claim 1, wherein the communication module, upon receiving instruction from the patient, the remote computer system or a remote health care provider, further comprises means for interrogating the IMD to assess the operational performance thereof, upload data therefrom, or assess the health status of the patient.

15. The system of claim 14, the wherein communication module further comprises means for storing information obtained from the IMD in a computer readable medium.

16. The system of claim 14, wherein the communication module further comprises means for relaying information obtained from the IMD to the remote computer via the mobile telephone.

17. The system of claim 1, wherein the communication module, upon receiving instruction from the remote computer or a remote health care provider, further comprises means for interrogating the IMD to assess the operational performance thereof, upload data therefrom, or assess the health status of the patient.

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18. The system of claim 17, wherein the communication module further comprises means for storing information obtained from the IMD in a computer readable medium.

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19. The system of claim 17, wherein the communication module further comprises means for relaying information obtained from the IMD to the remote computer via the mobile telephone.

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20. The system of claim 1, wherein the communication system further comprises at least one of a mobile telephone network, the Internet, a Local Area Network (LANs), a Wide Area Network (WAN), an Integrated Services Digital Network (ISDN), a Public Switched Telephone Network (PSTNs), a wireless network, an asynchronous transfer mode (ATM) network, and a satellite.

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21. The system of claim 1, wherein the communication module further comprises means for managing and updating software relating to at least one of the operational and functional parameters of the communication module or the IMD.

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22. The system of claim 1, wherein the communication module further comprises means for defecting a fault in the operation or circuitry thereof.

23. The system of claim 22, wherein the communication module further comprises means for correcting a detected fault in operation or circuitry the communication

module and means for notifying the remote computer system or the patient that the fault has been detected or corrected.

24. The system of claim 1, wherein the communication module further comprises means for defecting a fault in the operation or circuitry of the IMD.

25. The system of claim 24, wherein the communication module further comprises means for correcting a detected fault in the operation or circuitry of the IMD and means for notifying the remote computer system or the patient that a fault has been detected or corrected.

26. The system of claim 1, further comprising means for mining at least one of patient history, performance parameter integrity and software status from the communication module.

27. The system of claim 1, further comprising means for generating automatic invoices in response to a patient-initiated, IMD-initiated, remote computer system-initiated, communication module-initiated, mobile phone-initiated and a PDA-initiated transmission or reception of information that one of originates in or relates to the IMD.

28. The system of claim 1, wherein the communication module comprises at least one of means for monitoring the performance of the IMD, and means for monitoring physiologic signals or data indicative of the patient's health status.

29. A communication system for at least one of monitoring the performance of an implantable medical device (IMD) implanted within a body of a patient, monitoring the health of the patient and remotely delivering a therapy to the patient through the

IMD, the IMD being capable of bi-directional communication with at least one of a mobile telephone and a Personal Data Assistant (PDA) located external to the patient's body, the system comprising:

- (a) the IMD, the IMD comprising a memory having software loaded therein and means for permitting the software to be at least one of updated and reprogrammed after the IMD has been implanted within the patient's body;
- (b) the at least one of the mobile telephone and the PDA, the at least one of the mobile telephone and the PDA further comprising means for at least one of updating and reprogramming at least portions of the software loaded in the IMD, the at least one of the mobile telephone and the PDA being capable of receiving information from or relaying information to the IMD;
- (c) a remote computer system capable of initiating the downloading of updated or new software to the IMD via the communication system and the communication module; and
- (d) a communication system capable of bi-directional communication with the at least one of the mobile telephone and the PDA.

30. The system of claim 29, wherein the PDA is incorporated into the mobile telephone.

31. The system of claim 29, wherein the PDA is operably connected to the mobile telephone.

32. The system of claim 29, wherein the IMD and the at least one of the mobile telephone and the PDA communicate with one another using radio-frequency telemetry.

33. The system of claim 29, wherein the at least one of the mobile telephone and the PDA further comprises at least one of a microprocessor, a controller, a CPU, a computer readable memory operably connected to a processor, and at least one RF communications circuit for transmitting information to and receiving information from the IMD.

34. The system of claim 29, wherein the at least one of the mobile telephone and the PDA further comprises a data output port, cable and connector for connection to an external device.

35. The system of claim 29, wherein the at least one of the mobile telephone and the PDA further comprises in a memory thereof computer readable software for initiating and maintaining communications with the IMD using standardized handshake protocols.

36. The system of claim 29, wherein the at least one of the mobile telephone and the PDA further comprises at least one of a telemetry signal strength indicator and a telemetry session success indicator.

37. The system of claim 29, wherein the at least one of the mobile telephone and the PDA further comprises at least one of volatile RAM, non-volatile RAM, ROM, EEPROM, a hard or floppy disk, and flash memory for storing at least one of patient data, IMD data, and software.

38. The system of claim 29, wherein the at least one of the mobile telephone and the PDA further comprises at least one of a real-time clock, a battery, a serial output interface and a parallel output interface.

39. The system of claim 29, wherein the at least one of the mobile telephone and the PDA is adapted to receive electrical power from at least one of a portable energy source disposed therewithin or connected thereto and household line ac power.

40. The system of claim 29, wherein the PDA is plug-and-play compatible with the mobile telephone.

41. The system of claim 29, wherein the at least one of the mobile telephone and the PDA, upon receiving instruction from the patient, the remote computer system or a remote health care provider, further comprises means for interrogating the IMD to assess the operational performance thereof, upload data therefrom, or assess the health status of the patient.

42. The system of claim 41, wherein the at least one of the mobile telephone and the PDA further comprises means for storing information obtained from the IMD in a computer readable medium.

43. The system of claim 41, wherein the at least one of the mobile telephone and the PDA further comprises means for relaying information obtained from the IMD to the remote computer via the mobile telephone.

44. The system of claim 29, wherein the at least one of the mobile telephone and the PDA, upon receiving instruction from the remote computer or a remote health care provider, further comprises means for interrogating the IMD to assess the operational performance thereof, upload data therefrom, or assess the health status of the patient.

45. The system of claim 44, wherein the at least one of the mobile telephone and the PDA further comprises means for storing information obtained from the IMD in a computer readable medium.

5 46. The system of claim 45, wherein at least one of the mobile telephone and the PDA further comprises means for relaying information obtained from the IMD to the remote computer via the mobile telephone.

10 47. The system of claim 29, wherein the communication system further comprises at least one of a mobile telephone network, the Internet, a Local Area Network (LANs), a Wide Area Network (WAN), an Integrated Services Digital Network (ISDN), a Public Switched Telephone Network (PSTNs), a wireless network, an asynchronous transfer mode (ATM) network, and a satellite.

15 48. The system of claim 29, wherein the at least one of the mobile telephone and the PDA further comprises means for managing and updating software relating to at least one of the operational and functional parameters of the communication module or the IMD.

20 49. The system of claim 29, wherein the at least one of the mobile telephone and the PDA further comprises means for defecting a fault in the operation or circuitry thereof.

25 50. The system of claim 49, wherein the at least one of the mobile telephone and the PDA further comprises means for correcting a detected fault in operation or circuitry the communication module and means for notifying the remote computer system or the patient that the fault has been detected or corrected.

51. The system of claim 29, wherein the at least one of the mobile telephone and the PDA further comprises means for defecting a fault in the operation or circuitry of the IMD.

5 52. The system of claim 51, wherein the at least one of the mobile telephone and the PDA further comprises means for correcting a detected fault in the operation or circuitry of the IMD and means for notifying the remote computer system or the patient that a fault has been detected or corrected.

10 53. The system of claim 29, further comprising means for mining at least one of patient history, performance parameter integrity and software status from the at least one of the mobile telephone and the PDA.

15 54. The system of claim 29, further comprising means for generating automatic invoices in response to a patient-initiated, IMD-initiated, remote computer system-initiated, communication module-initiated, mobile phone-initiated and a PDA-initiated transmission or reception of information that one of originates in or relates to the IMD.

20 55. The system of claim 29, wherein the at least one of the mobile telephone and the PDA comprises at least one of means for monitoring the performance of the IMD, and means for monitoring physiologic signals or data indicative of the patient's health status.

25 56. A software updating communication module for use in conjunction with an implantable medical device (IMD) implanted within a body of a patient, the IMD being capable of bi-directional communication with a communication module located external to the patient's body, wherein the system comprises the IMD, the module, a

mobile telephone, a remote computer system and a communication system, the IMD comprising a memory having software loaded therein and means for permitting the software to be at least one of updated and reprogrammed after the IMD has been implanted within the patient's body, the mobile telephone being operably connected to the communication module and capable of uploading software therefrom or downloading software thereto, the remote computer system being capable of initiating the downloading of updated or new software to the IMD via the communication system and the communication module, the communication system being capable of bi-directional communication with the mobile phone and the remote computer system, the communication module further comprising means for at least one of updating and reprogramming at least portions of the software loaded in the IMD.

57. At least one of a mobile telephone and a Personal Data Assistant (PDA) for facilitating updating and installing new software in an implantable medical device (IMD) implanted within a body of a patient, the IMD being capable of bi-directional communication with the at least one of the mobile telephone and the PDA located external to the patient's body, the at least one of the mobile telephone and the PDA forming a portion of a system comprising the IMD, the at least one of the mobile telephone and the PDA, a remote computer and a communication system, the IMD comprising a memory having software loaded therein and means for permitting the software to be at least one of updated and reprogrammed after the IMD has been implanted within the patient's body, the at least one of the mobile telephone and the PDA further comprising means for at least one of updating and reprogramming at least portions of the software loaded in the IMD, the at least one of the mobile telephone and the PDA being capable of uploading software from or downloading software to the IMD, the remote computer system being capable of initiating the downloading of updated or new software to the IMD via the communication system and the at least one of the mobile telephone and the PDA, the communication system

being capable of bi-directional communication with the at least one of the mobile telephone and the PDA.

5 58. A method of updating or installing new software in an implantable medical device (IMD) implanted in a patient, the IMD being capable of bi-directional communication with a communication module located external to the patient's body, the IMD comprising a memory having software loaded therein and means for permitting the software to be at least one of updated and reprogrammed after the IMD has been implanted within the patient's body, the IMD forming a portion of a system
10 comprising the IMD, a communication module, a mobile telephone capable of being operably connected to the communication module and capable of receiving information therefrom or relaying information thereto, a remote computer system, and a communication system capable of bi-directional communication with the mobile phone and the remote computer system, the method comprising:

- 15 (a) the patient or the remote computer system determining that at least one of at least portions of the software loaded in the memory of the IMD should be updated and or changed, and
(b) transmitting new or updated software to the IMD via the mobile telephone and the communication module.
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25 59. A method of updating or installing new software in an implantable medical device (IMD) implanted in a patient, at least one of a mobile telephone and a Personal Data Assistant (PDA) located external to the patient's body, the IMD comprising a memory having software loaded therein and means for permitting the software to be at least one of updated and reprogrammed after the IMD has been implanted within the patient's body, the IMD forming a portion of a system comprising the IMD, the at least one of the mobile telephone and the PDA, a communication system and a remote computer system, the at least one of the mobile telephone and the PDA being capable

of receiving information from or relaying information to the IMD, a remote computer system, and a communication system capable of bi-directional communication with the at least one of the mobile telephone and the PDA, the method comprising:

- (a) the patient or the remote computer system determining that at least one of at least portions of the software loaded in the memory of the IMD should be updated and or changed, and
- (b) transmitting new or updated software to the IMD via the at least one of the mobile telephone and the PDA.

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